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ABSTRACT

The Basic Skills Learning System is a modularized network of computer assisted tutorials, drills, tests, printed materials, and videotaped presentations directed at improving the basic reading, math, and language skills of adults who have mastered these skills at a level above third grade but below eighth grade. Advanced computer technology enables the system to locate and apply instructional methods which will enhance learning motivation, reinforce increased student achievement in the basic skills, and develop an improved model of management for student learning. Initial performance data from eight demonstration projects in adult basic education centers, correctional institutions, and public schools in Minnesota, Texas, and Maryland, indicates that learners gained on the average one entire year in reading after less than 12 hours of instruction, and one and one-half grade levels in math in less than 20 hours of instruction. Also, drop-out rates which usually reach as high as 50 percent in adult programs were less than five percent. These as well as other data seem encouraging and indicate that the Basic Skills Learning System offers a significantly effective instructional alternative. (Author)

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A Computer Based System of Reading Instruction for Adult Non-Readers

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A COMPUTER BASED SYSTEM OF READING

INSTRUCTION FOR ADULT NON-READERS

Concern among educators for improved achievement in the basic skills has reached national proportions. It is estimated that 23 million adults in the United States read at less than an eighth grade level (USOE, 1975). Most of these individuals cannot be trained to enter the skilled labor force or achieve any measurable degree of productivity in the armed forces. United States Navy figures, for example, indicate that in many urban recruitment centers almost fifty percent of all applicants are disqualified because of illiteracy. Of those who are accepted for military service, twenty percent are dismissed after basic training. This represents a total manpower loss of over 20,000 men per year in the military alone (Rizza, 1977).

The problem of illiteracy in America cannot be traced entirely to inadequate public schools. It is the result of a complex interaction of factors which find their source in the social, economic and cultural roots of the society itself. Individuals who fail to master basic skills often share learning problems which are related to many causes. The following represent just a few (Ornstein, 1966):

1. Lack of a rich language experience
2. Few varied life experiences
3. Little motivation resulting from
    a. Limited success in school subjects and life adjustment
    b. Lack of self-esteem and a sense of self-worth
    c. A conviction of being a failure and remaining one
    d. Few hopes or ambitions for future success or happiness
4. Family problems.

By the time these individuals reach adulthood they have little hope for success and even fewer prospects. Adult basic literacy programs must attempt to overcome previous debilitating factors in these learners and at the same time attend to the broad differences in chronological age, life experiences, and physical and mental health found in this population. An instructional program capable of responding to differences as great as these must use individualized instructional techniques which locate and apply instructional methods which will enhance learning motivation, reinforce increased student achievement and develop an improved model of management for student learning. Control Data Corporation has responded to this problem by applying the unique capabilities of its PLATO Computer Based Education System to the perplexing problems of adult basic education.

In consultation with a variety of universities and centers for research and development, Control Data has developed an Adult Basic Skills Learning System which will enable participants to achieve at least an eighth grade equivalency in reading, math and language skills. The instructional system utilizes a multimedia approach designed to be managed and implemented through a modularized network of computer assisted lessons, drills, tests, off-line workbooks and videotaped presentations. This paper will focus primarily on the reading component of this curriculum but information about the math and language skills segments can be found in other sources (Heimer and Rizza, 1978).

The Basic Skills Learning System is an independent, modularized, systematic organization of courseware. The reading component of the curriculum is broadly divided into five (5) content strands. Each strand embraces

a set of concepts and skills which have been ordered hierarchically according to common and expected patterns for meaningful learning and translated into precise learning objectives. The five strands are:

STRAND 1: Structural Analysis

Structural Analysis examines the structure of words. In this area compound words and contractions are examined, root words are identified, and the effect of affixes and inflectional endings are analyzed. As soon as the student can perceive whole structural units, structural analysis becomes a rapid and effective method of word attack.

STRAND 2: Vocabulary Development

Vocabulary Development is the base on which comprehension rests. In this strand new words and their meanings are introduced and the meanings of familiar words deepened, extended, and amplified. Words are interpreted in context, defined in isolation, and practiced in a variety of situations.

STRAND 3: Literal Comprehension

At this level, students are presented with traditional comprehension skills such as finding the main idea, locating basic facts, putting events in their proper order, and remembering details.

STRAND 4: Interpretive Comprehension

Here students develop the ability to "read between the lines." In this area readers must call upon their own knowledge and experience in order to ascribe meaning to the author's words.

STRAND 5: Evaluative Comprehension

Activities in this strand require the reader to understand the literal

meaning of selection, to interpret what he has read, and to make judgments about its content and style.

Within each strand reading content is further divided into various subskills. In STRAND 1 (Structural Analysis), for example, subskills, or clusters, include instruction in concepts such as simple verb endings, contractions, abbreviations and compound words. This modular structure allows the learner individual progress in each subskill by teaching to points of weakness and provides for many opportunities for interaction and feedback.

When students enter the program, a profile of their entering achievement levels must be determined. This is done strand by strand by employing inventory tests. These tests are administered by using a contingency strategy based on the use of criterion-referenced tests. After students have been administered the inventory tests, their achievement profile for each strand is graphically displayed on the PLATO screen.

Instruction within each strand is presented through a series of clusters. Each cluster is a meaningful grouping of objectives dealing with related content, e.g., vocabulary using context clues. Each cluster is constructed to include a complete spectrum of instructional techniques. Each contains a tutorial, a drill and practice, a review help sequence, an off-line activity, and a mastery test. The purpose of each of these instructional components is as follows:

TUTORIAL--presentation of new material to the learner on the objectives within a cluster. It is characterized by concept explanation, demonstration, explanation, and/or inquiry, as well as student assessment, branching and feedback.

DRILL AND
PRACTICE--presents a series of drill examples of similar form on each objective in the cluster. It is designed to strengthen the newly acquired skill(s).

REVIEW HELP
SEQUENCE--presents a capsulated form of the cluster tutorial for review and refresher purposes.

OFF-LINE
ACTIVITY--presents an off-line form of the drill and practice materials to allow students to strengthen the newly acquired skills away from the terminal.

MASTERY TEST--presents a series of test items designed to evaluate the student's achievement across competencies addressed by the cluster.

Summarizing, then, the Basic Skills Reading System assesses each learner for placement and diagnostic purposes by a series of inventory assessment instruments which accompany each strand in the system. Progress, retention, and achievement are measured by the mastery and retention tests which accompany each cluster throughout the instructional system.

Earlier in this discussion, we outlined a number of factors which contribute to the illiteracy of adults. These factors greatly influenced the design of the Basic Skills Learning System in Reading. The System is designed to provide the learner with a rich, varied language environment. Instruction is based on a "mastery" approach which emphasizes the successful accomplishment of each instructional objective before the learner may proceed to more difficult content. In short, the curriculum creates a

learning situation where learners can experience success and receive immediate feedback on their work.

More specifically, the learning system is constructed to fulfill the following requirements:

Criterion Number 1

The system is totally individualized and offers a highly adaptive and responsive learning environment.

The sophisticated capabilities of the PLATO CBE System allow reading instruction to take into account each and every student response. The materials developed for the Basic Skills Learning System were designed to adapt the amount and extent of instruction to the individual needs of each student. The common techniques usually employed in CAI "courseware" of self-pacing and individualized branching are further augmented by the ability of the Learning System to handle student controlled selection of instructional techniques while providing for a tailoring of teaching to individual performance. In this way, learners are helped to select the pathway through the material which is most appropriate for their needs. Reading instruction presented through such a learning system provides the learner with a rich and varied language experience and provides immediate and frequent feedback to responses.

Criterion Number 2

The individual curricula are modularized and structured in coherent, hierarchical patterns.

The flexibility of the curriculum lies in its ability to present to the learner a cohesive, comprehensive curriculum organized in a hierarchy

of skills from the simple to the more complex. The Basic Skills Learning System curriculum materials specifically address each and every necessary skill in the defined content areas in a manner that does not leave topics unattended or require extensive instruction in any topics already mastered. One of the critical design premises is that students will not be presented instruction on topics for which they have not demonstrated competency in the prerequisite entry skills. This reduces student frustration and increases curriculum effectiveness. Instruction presented in small, well-defined units is less intimidating to students than large blocks of material. Success in mastering each small unit helps learners gain confidence and motivates them toward future rewards.

Criterion Number 3

The intended learning outcomes of the system are carefully articulated in terms of performance objectives.

Students begin with the simplest objectives, and progress to the most complex; this approach minimizes student frustration, and allows students to measure their own success and progress. The accuracy of the curriculum is based primarily on the specific definition of the objective in terms of performance competencies. When one takes into account the target population's desire to acquire skills necessary for improvement of their basic skills to lead to better employment possibilities, one is lead directly to consider only performance objectives which are directly related to skills necessary to perform in the working world. In the reading curriculum, for example, vocabulary is presented within contexts which are a part of the

learner's life experiences. Statements and stories in the curriculum are derived from situations such as paying bills, reading newspapers, buying at the grocery store and many other common experiences.

Criterion Number 4

The mastery learning paradigm is employed as a basis of advance.

The effectiveness of the reading curriculum is contingent upon the employment of the Mastery Learning Paradigm. This fundamental approach requires that students demonstrate mastery of prerequisite skills before moving on to work on higher order skills. By virtually "guaranteeing" learning, the model minimizes student frustration and enhances learner success because the most efficient use is made of the student's time.

Criterion Number 5

Diagnostic and prescriptive strategies are utilized.

The efficiency of the system is due primarily to the diagnostic inventory made of the skills of each entering learner. Each incoming student is assessed to identify skill deficiencies. This information is used to place each student appropriately within the curriculum and to direct learners to the instructional material most appropriate to their needs. The system continuously prescribes the list of available lesson strategies for a given Cluster of objectives within the Strand on which the student is currently working.

Criterion Number 6

A multi-sensory learning format is employed.

In an attempt to document the effectiveness of this approach to improve reading skills, the Basic Skills Learning System was implemented in three (3) test sites which serve adult non-readers. Evaluation studies at these sites were conducted between January and June of 1978 and included a variety of adult populations. The test sites and the results of the evaluations are summarized below. Each site sought to discover various types of information; therefore, the nature of the data varies for each site. For example, some sites used comparison groups while another was interested primarily in grade level gains.

Adult Learning Center, Baltimore, Maryland: February - June 1978

Number of Students	Average Time on PLATO/Student	Average Grade Level Gain	Expected School Time for Similar Growth
24	15 hrs.	0.8 grades	120 hrs.

Two projects in Minnesota compared the computer based Basic Skills Learning System (BSLS) with traditional educational programs used at each site. Each site utilized approximately twenty (20) students and utilized data collected between February through June of 1978.

Site	BSLS	Traditional
Stillwater Prison Stillwater, Minnesota	15 hrs. *1.62 grade gain	0.0 grade gain
Fair Break (Adult Basic Education Center) St. Paul, Minnesota	11 hrs. *1.80 grade gain	0.0 grade gain

In summary, adult learners using the Basic Skills Learning System to improve reading skills averaged a 1.12 grade level gain in reading achievement after an average instructional time of 13.0 hours. Further

*Statistically significant gain

analysis of the data reveals that an average learning time required to generate a 1.0 grade level gain would require 18.34 hours of computer based reading instruction. A more detailed analysis of this data is offered by Rizza and Hunter, 1978.

These results are encouraging if not outright dramatic. The motivational acceptance of the Learning System is a result of extensive use of the interactive Control Data PLATO system, integrated with a multi-media support package. This multi-sensory approach is often successful with students who have difficulty achieving in text-oriented, passive learning environments and carries with it a compelling novelty effect which most learners find extremely motivating. Also, when set in the proper learning environment this effect can sustain itself over the duration of the instructional sequence.

In summary, the presentation of reading instruction through the CBE learning system offers a number of advantages to illiterate adults which compensate for many earlier learning problems. The curriculum is individualized so that it adjusts learner progress in reading subskills by teaching to points of weakness and provides for more opportunities for interaction and feedback than could be expected in a traditional classroom. Teaching for mastery insures large measures of success and builds student confidence and feelings of self-worth as they make progress through individual clusters. A multi-sensory learning environment provides a rich experience in which to learn new concepts and ideas. Finally, the modularized organization allows for flexible adaptation to a wide variety of learning needs and situations (Caldwell and Rizza, 1977).

A further point to be considered is that the development of the Basic Skills Reading Curriculum utilized many factors which seemed to influence reading instruction. For example, in any single tutorial of 15-20 minutes, no more than five new words are introduced into the lesson. Once introduced these words are repeated and reinforced with regular frequency throughout the tutorial and drill-practice. Other factors taken into consideration were (Caldwell, 1974):

1. Comprehension is a part of each lesson.
2. The reading material provides adequate contextual support to enable the reader to make a correct response.
3. Spelling and writing are tied to reading instruction in every situation where it is appropriate.
4. Syntactic structure is compatible with what the learner brings to the learning situation.
5. In situations where multiple choice items are used, only one choice is both syntactically and semantically appropriate. This allows the learner to use what he already knows about how language works to make a correct response.

In short, the technology for offering extensive, low cost instruction in the basic skills exists in the PLATO computer based educational system. Development of an efficient courseware generation strategy can be coupled with PLATO's unique capabilities in order to help solve some of the perplexing problems of adult literacy.

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